REG-WR-00005-2013.001

USEPA Federal Minor NSR Program Registration on Indian Country
Steamboat Butte E-5 Tank Battery
Marathon Oil Corporation

Prepared by :

Marathon Oil Corporation
Rocky Mountain Operations
1501 Stampede Avenue
Cody, WY 82414

December 2012

OMB Control No. 2060-0003
Approval expires 04/30/2012

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
FEDERAL MINOR NEW SOURCE REVIEW PROGRAM IN INDIAN COUNTRY
40 CFR 49.151

Registration for Existing Sources
(FORM REG)

Please submit information to following two entities:

Federal Minor NSR Permit Coordinator
U.S. EPA, Region 8
1595 Wynkoop Street, 8P-AR
Denver, CO 80202-1129
R8airpermitting@epa.gov

For more information, visit:
http://www.epa.gov/region08/air/permitting/tmnsr.html

The Tribal Environmental Contact for the specific reservation:

If you need assistance in identifying the appropriate Tribal Environmental Contact and address, please contact: R8airpermitting@epa.gov

A. GENERAL SOURCE INFORMATION

1. Company Name Marathon Oil Corporation	**2. Source Name** E5 Battery
3. Type of Operation Oil Production	**4. Portable Source?** Yes ☐ No ☑ **5. Temporary Source?** Yes ☐ No ☑
6. NAICS Code 211111	**7. SIC Code** 1311
8. Physical Address (home base for portable sources) 27 Maverick Springs Road Kinnear, WY 82516	

9. Reservation*	**10. County***	**11a. Latitude***	**11b. Longitude***
Wind River	Fremont	43.265284	-108.904419
12a. Quarter-Quarter Section*	**12b. Section***	**12c. Township***	**12d. Range***
NESW	5	3N	1W

* Provide all locations of operation for portable sources

B. CONTACT INFORMATION

1. Owner Name Marathon Oil Corporation	Title
Mailing Address 1501 Stampede Avenue, Cody, WY 82414	
Email Address	
Telephone Number (307) 587-4961	Facsimile Number

2. Operator Name (if different from owner) Marathon Oil Corporation	Title
Mailing Address 1501 Stampede Avenue, Cody, WY 82414	
Email Address	
Telephone Number (307) 587-4961	Facsimile Number

3. Source Contact Jacob Parker	Title HES Professional
Mailing Address 27 Maverick Springs Road, Kinnear, WY 82516	
Email Address jacobparker@marathonoil.com	
Telephone Number (307) 856-6228 ext. 2237	Facsimile Number (307) 857-1299

4. Compliance Contact Jacob Parker	Title HES Professional
Mailing Address 27 Maverick Springs Road, Kinnear, WY 82516	
Email Address jacobparker@marathonoil.com	
Telephone Number (307) 856-6228 ext. 2237	Facsimile Number (307) 857-1299

C. ATTACHMENTS

Include all of the following information as attachments to this form

Narrative description of the operations

Identification and description of all emission units and air pollution generating activities (with the exception of the exempt emissions units and activities listed in §49.153(c)

Identification and description of any existing air pollution control equipment and compliance monitoring devices or activities

Type and amount of each fuel used

Type raw materials used

Production Rates

Operating Schedules

Any existing limitations on source operations affecting emissions or any work practice standards, where applicable, for all regulated NSR pollutants at your source.

Total allowable (potential to emit if there are no legally and practically enforceable restrictions) emissions from the air pollution source for the following air pollutants: particulate matter, PM_{10}, $PM_{2.5}$, sulfur oxides (SOx), nitrogen oxides (NOx), carbon monoxide (CO), volatile organic compound (VOC), lead (Pb) and lead compounds, fluorides (gaseous and particulate), sulfuric acid mist (H_2SO_4), hydrogen sulfide (H_2S), total reduced sulfur (TRS) and reduced sulfur compounds, including all calculations for the estimates.

Estimates of the total actual emissions from the air pollution source for the following air pollutants: particulate matter, PM_{10}, $PM_{2.5}$, sulfur oxides (SO_x), nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compound (VOC), lead (Pb) and lead compounds, fluorides (gaseous and particulate), sulfuric acid mist (H_2SO_4), hydrogen sulfide (H_2S), total reduced sulfur (TRS) and reduced sulfur compounds, including all calculations for the estimates.

Other

D. TABLE OF ESTIMATED EMISSIONS

The following estimates of the total emissions in tons/year for all pollutants contained in your worksheet stated above should be provided.

Pollutant	Total Actual Emissions (tpy)	Potential Emissions (TPY)
PM	0.00	0.00
PM_{10}	0.00	0.00
$PM_{2.5}$	0.00	0.00
SO_x	87.87	109.00
NO_x	2.28	4.23
CO	8.46	15.72
VOC	41.72	60.42
Pb	0.00	0.00
Fluorides	0.00	0.00
H_2SO_4	0.00	0.00
H_2S	3.94	6.23
TRS	0.00	0.00
RSC	0.00	0.00

PM - Particulate Matter
PM_{10} - Particulate Matter less than 10 microns in size
$PM_{2.5}$ - Particulate Matter less than 2.5 microns in size
SOx - Sulfur Oxides
NOx - Nitrogen Oxides
CO - Carbon Monoxide
VOC - Volatile Organic Compound
Pb - Lead and lead compounds
Fluorides - Gaseous and particulates
H_2SO_4 - Sulfuric Acid Mist
H_2S - Hydrogen Sulfide
TRS - Total Reduced Sulfur
RSC - Reduced Sulfur Compounds

Emissions calculations must include fugitive emissions if the source is one the following listed sources, pursuant to CAA Section 302(j):

(a) Coal cleaning plants (with thermal dryers);
(b) Kraft pulp mills;
(c) Portland cement plants;
(d) Primary zinc smelters;
(e) Iron and steel mills;
(f) Primary aluminum ore reduction plants;
(g) Primary copper smelters;
(h) Municipal incinerators capable of charging more than 250 tons of refuse per day;
(i) Hydrofluoric, sulfuric, or nitric acid plants;
(j) Petroleum refineries;
(k) Lime plants;
(l) Phosphate rock processing plants;
(m) Coke oven batteries;
(n) Sulfur recovery plants;
(o) Carbon black plants (furnace process);
(p) Primary lead smelters;
(q) Fuel conversion plants;
(r) Sintering plants;
(s) Secondary metal production plants;
(t) Chemical process plants
(u) Fossil-fuel boilers (or combination thereof) totaling more than 250 million British thermal units per hour heat input;
(v) Petroleum storage and transfer units with a total storage capacity exceeding 300,000 barrels;
(w) Taconite ore processing plants;
(x) Glass fiber processing plants;
(y) Charcoal production plants;
(z) Fossil fuel-fired steam electric plants of more that 250 million British thermal units per hour heat input, and
(aa) Any other stationary source category which, as of August 7, 1980, is being regulated under section 111 or 112 of the Act.

will actually emit in coming years, you may submit an estimate of projected actual emissions along with the actual emissions from the preceding calendar year and the rationale for the projected actual emissions. For a source that has not operated for an entire year, the actual emissions are the estimated annual emissions for the current calendar year.

4. The emission estimates can be based upon actual test data or, in the absence of such data, upon procedures acceptable to the Reviewing Authority. The following procedures are generally acceptable for estimating emissions from air pollution sources:

   (i) Source-specific emission tests;
   (ii) Mass balance calculations;
   (iii) Published, verifiable emission factors that are applicable to the source. (i.e., manufacturer specifications).
   (iv) Other engineering calculations; or
   (v) Other procedures to estimate emissions specifically approved by the Reviewing Authority.

5. Guidance for estimating emissions can be found at http://www.epa.gov/ttn/chief/efpac/index.html.

Attachments:
Section C

NARRATIVE DESCRIPTION OF OPERATIONS AND LOCATION

Marathon Oil

Facility Process Description

The Steamboat Butte E-5 Tank Battery treats and stores a crude and water emulsion gathered from field wells constructed prior to 1970. The E-5 facility was grandfathered with respect to the to the Clean Air Act and New Source Review programs and has only recently become subject to permitting requirements under 40 CFR Part 71, Federal Operating Permit Programs when the facilities sulfur dioxide emissions exceeded 100 tons per year major source permitting threshold. The Steamboat Butte operation is located on the Wind River Reservation located in Fremont County, Wyoming. The E-5 facility is located at Latitude 43° 15' 55.07" North, Longitude 108° 54' 15.38" West.

An emulsion consisting of crude and water is gathered from field wells and is transferred to the E-5 tank battery facility. The emulsion sent to E-5 is processed through a free water knockout vessel which gravimetrically separates undispersed water from the remainder of the emulsion. The produced water is sent to small on-site water storage tanks where it is accumulated for low pressure injection. The dewatered emulsion is fed to a treater which further promotes the separation of water and crude oil. Produced oil is stored in the E-5 oil storage tanks until transfer to the sales line. Vapors resulting from the treatment process are routed to the production flare. Vapors from the oil storage tanks are directed to the facility tank flare for employee safety requirements. Vapors from the E-5 water storage tanks are vented to atmosphere.

Driving Directions and Facility Visitor Requirements

The Steamboat Butte field office is located at 27 Maverick Springs Road, Kinnear, WY 82516 and the office phone number is (307) 856-6228. Driving direction to the office from Riverton are as follows:

> Take Highway 26 coming west out of Riverton toward Dubois. After passing mile marker 106 take a right turn onto Diversion Dam Road. Travel about 1.5 miles to Maverick Springs Road. Turn right on the Maverick Springs Road and the Marathon office is located in the blue steel sided building on the left-hand side of the road.

All visitors are required to check in with operations personnel at the Steamboat Butte field office prior to visiting any of the facilities. Visitors must be accompanied by a Marathon employee while visiting the facilities. Marathon requests that all visitors wear standard safety equipment including an H_2S monitor, fire resistant clothing, steel toed shoes, safety glasses, hard hat, and hearing protection where designated. Marathon can supply an H_2S monitor to a visitor in the event that they do not have one readily available. Marathon also recommends that their basic safety orientation training be completed by all visitors prior to entering the facilities.
Marathon requests that the travel and safety information being provided in this response remain privy to EPA records only and that it not be published in public documents such as the draft or final permit.

Pop and Rupture Tank

The pop and rupture tank is used for pressure relief containment. The pressure relief system for vessels located at these facilities direct the production stream (fluids and gas) to the pop and rupture tanks should the pressure of any of these vessels reach set pressure levels that approach the pressure rating of the subject vessel. This system directs the production to a safe location and prevents liquid releases. Pressure relief situations are upset type of occurrences that cannot be predicted and do not occur routinely. The pop and rupture tank located at the E-5 facility also serve as liquid flare knock-out. Volumes sent to the pop and rupture tank are accounted for in the facility throughputs utilized for emission calculations.

Lined Revetments

Lined revetments are used to store contaminated soil until such times as it can be utilized as road materials. The petroleum processed at the site has a high average molecular weight and low vapor pressure so emissions from the contaminated soil is assumed to be negligible.

Emission Unit:
E-5 Water Storage Tank Battery

PRECISION ANALYSIS

423 ELIZABETH DR, RIVERTON, WY 82501
PHONE: 307-856-0866, CELL: 307-851-7046
E-MAIL: INFO@PRECISION-LABS.COM
WWW.PRECISION-LABS.COM

Run File	C:\Galaxie Workstation\data\12_03_01\C 1 WATER TANK COMB2_2.DATA		
Method	S3_BTEX(2CH)H2S(H)		
Operator	User1	**Analysis Date**	3/1/2012
Client:	MARATHON	**Date Sampled:**	3/1/2012
Sample Identification:	C1 WATER TANK COMB	**Purpose:**	
Unique #:		**Pressure (PSI):**	4
Temperature (DEG F):		**Sample Type:**	ON SITE
Sampled By:	JACOB MCKERCHIE	**County:**	FREMONT

Component	Mole %	BTU	GPM
Hydrogen Sulfide	9.7092	62.0011	0.0000
Nitrogen (N2)	10.0474	0.0000	0.0000
Carbon Dioxide	37.4122	0.0000	0.0000
Methane (CH4)	24.0676	243.6451	0.0000
Ethane (C2)	6.9401	123.1029	1.8556
Propane (C3)	4.8373	121.9937	1.3323
iso-Butane (i-C4)	1.0127	33.0078	0.3313
Butane (C4)	2.0661	67.5589	0.6512
iso-Pentane (i-C5)	1.1303	45.3280	0.4133
Pentane (C5)	0.8879	35.6753	0.3218
Hexanes (C6+)	1.1376	58.4853	0.4899
Heptanes (C7)	0.4101	22.6160	0.1891
Octanes (C8)	0.1921	12.0315	0.0984
Nonanes (C9)	0.0093	0.6532	0.0052
Decanes+	0.0369	2.8627	0.0227
Benzene	0.0575	2.1550	0.0161
Toluene	0.0446	1.9984	0.0149
Ethylbenzene	0.0011	0.0553	0.0004
Xylenes	0.0002	0.0095	0.0001
Totals	100.0000	833.1797	5.7423

Specific Gravity from Composition	1.2418				
BTUs @ 14.730 Saturated	818.6791	**BTUs @**	**14.730**	**Saturated (Real)**	823.7695
BTUs @ 14.730 Dry	833.1797	**BTUs @**	**14.730**	**Dry (Real)**	838.3603
Compressibility	0.99382				

Bryan Research & Engineering, Inc.

ProMax® 3.2

with

TSWEET® & PROSIM®

Simulation Report

Project: Water Tank Simulation.pmx

Licensed to Compliance Partners Incorporated and Affiliates

Client Name: Marathon Oil Company
Location: Steamboat Butte
Job: C-1/C-3 Title V Application

ProMax Filename: G:\Projects\CDM\Marathon Steamboat Butte\April 2012\Water Tank Simulation.pmx
ProMax Version: 3.2.11188.0
Simulation Initiated: 4/20/2012 4:01:36 PM

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Report Navigator can be activated via the ProMax Navigator Toolbar.
An asterisk (*), throughout the report, denotes a user specified value.
A question mark (?) after a value, throughout the report, denotes an extrapolated or approximate value.


Headspace
Saturated Tank Vapor
Water
SAT-1

Process Streams		Headspace	Saturated Tank Vapor	Water
Composition	Status:	Solved	Solved	Solved
Phase: Total	From Block:	--	SAT-1	--
	To Block:	SAT-1	--	SAT-1
Mole Fraction		%	%	%
Hydrogen Sulfide		9.56999*	9.40690	0
Nitrogen		9.79499*	9.62807	0
Carbon Dioxide		38.1798*	37.5291	0
Methane		23.9357*	23.5278	0
Ethane		6.76889*	6.65354	0
Propane		4.45180*	4.37593	0
Isobutane		0.988699*	0.971850	0
Butane		2.03360*	1.99894	0
Isopentane		1.17100*	1.15104	0
Pentane		0.948699*	0.932532	0
Cyclohexane		0.902999*	0.887611	0
Heptane		0.552999*	0.543576	0
Octane		0.146600*	0.144102	0
Nonane		0.00599999*	0.00589775	0
Decane		0.0214000*	0.0210353	0
Benzene		0.0500000*	0.0491479	0
Toluene		0.0305000*	0.0299802	0
Ethylbenzene		0.000999999*	0.000982958	0
m-Xylene		0.000699999*	0.000688070	0
Hexane		0.444700*	0.437121	0
Water		0*	1.70414	100
Mass Fraction		%	%	%
Hydrogen Sulfide		9.08399*	9.00565	0
Nitrogen		7.64230*	7.57639	0
Carbon Dioxide		46.7987*	46.3951	0
Methane		10.6948*	10.6025	0
Ethane		5.66880*	5.61992	0
Propane		5.46745*	5.42030	0
Isobutane		1.60052*	1.58671	0
Butane		3.29201*	3.26362	0
Isopentane		2.35310*	2.33280	0
Pentane		1.90639*	1.88995	0
Cyclohexane		2.11663*	2.09837	0
Heptane		1.54332*	1.53001	0
Octane		0.466404*	0.462382	0
Nonane		0.0214328*	0.0212480	0
Decane		0.0848040*	0.0840727	0
Benzene		0.108778*	0.107840	0
Toluene		0.0782698*	0.0775948	0
Ethylbenzene		0.00295689*	0.00293139	0
m-Xylene		0.00206982*	0.00205197	0
Hexane		1.06734*	1.05814	0
Water		0*	0.862390	100

Mass Flow	lb/h	lb/h	lb/h
Hydrogen Sulfide	3.26154*	3.26154	0
Nitrogen	2.74391*	2.74391	0
Carbon Dioxide	16.8027*	16.8027	0
Methane	3.83987*	3.83987	0
Ethane	2.03534*	2.03534	0
Propane	1.96305*	1.96305	0
Isobutane	0.574654*	0.574654	0
Butane	1.18197*	1.18197	0
Isopentane	0.844861*	0.844861	0
Pentane	0.684475*	0.684475	0
Cyclohexane	0.759959*	0.759959	0
Heptane	0.554116*	0.554116	0
Octane	0.167459*	0.167459	0
Nonane	0.00769530*	0.00769530	0
Decane	0.0304482*	0.0304482	0
Benzene	0.0390559*	0.0390559	0
Toluene	0.0281022*	0.0281022	0
Ethylbenzene	0.00106165*	0.00106165	0
m-Xylene	0.000743154*	0.000743154	0
Hexane	0.383221*	0.383221	0
Water	0*	0.312328	0.312328

Process Streams		Headspace	Saturated Tank Vapor	Water
Properties	Status:	Solved	Solved	Solved
Phase: Total	From Block:	--	SAT-1	--
	To Block:	SAT-1	--	SAT-1
Property	Units			
Temperature	°F	61	61	215.379
Pressure	psia	15.7	15.7	15.7
Mole Fraction Vapor	%	100	100	92.9088
Mole Fraction Light Liquid	%	0	0	7.09120
Mole Fraction Heavy Liquid	%	0	0	0
Molecular Weight	lb/lbmol	35.9043	35.5994	18.0153
Mass Density	lb/ft^3	0.101540	0.100680	0.0424062
Molar Flow	lbmol/h	1*	1.01734	0.0173369
Mass Flow	lb/h	35.9043	36.2166	0.312328
Vapor Volumetric Flow	ft^3/h	353.598	359.721	7.36516
Liquid Volumetric Flow	gpm	44.0849	44.8484	0.918254
Std Vapor Volumetric Flow	MMSCFD	0.00910763	0.00926553	0.000157898
Std Liquid Volumetric Flow	sgpm	0.117215	0.117840	0.000624367
Compressibility		0.993533	0.993515	0.920687
Specific Gravity		1.23968	1.22915	
API Gravity				
Enthalpy	Btu/h	-82174.0	-83979.1	-1805.05
Mass Enthalpy	Btu/lb	-2288.70	-2318.80	-5779.34
Mass Cp	Btu/(lb*°F)	0.290875	0.292257	0.497554
Ideal Gas CpCv Ratio		1.23647	1.23759	1.31923

Steamboat Butte E-5 New (2012) Heater Treater 2 Emissions

Pipeline Quality Natural Gas

Basis

Unit(s)	SBC1B-307	
Type	<100 MMBTU/hr	
Hours of Operation		8760 hrs
Fuel Heat Content (LHV)		1020 BTU/SCF
Heat Input Rate		2.7 MMBtu/hr
Annual Heat Input		23652 MMBtu
Annual Fuel Consumption		23.2 MMscf

Criteria Pollutant Emission Factors From AP-42 1.4.1 (Small Boilers), 1.4.2 and 1.4.3
(Cast into lb/MMBtu/hr assuming 1020 Btu/scf as noted in AP-42 footnote)
SO_2 Emission Factor Calculated by Material Balance Assuming 4 ppm H_2S Content (Pipeline Qualit
Greenhouse Gas Emission Factors From 40 CFR 98, Subpart C, Table C-1 & C-2
Greenhouse Global Warming Potential From 40 CFR 98, Subpart A, Table A-1

Emissions Estimate

Constituent	**Emission Factors**	**Emissions**	
	lb/MMBtu	lb/hr	tpy
NO_X	0.098	0.265	1.159
CO	0.082	0.222	0.974
VOC	0.005	0.015	0.064
Formaldehyde	7.353E-05	0.000	0.001
SO_2	0.001	0.002	0.008
PM	0.007	0.020	0.088
	kg/MMBtu		
CO_2	53.0200	315.6	1382
N_2O	0.0001	0.0006	0.003
CH_4	0.0010	0.0060	0.026
CO_{2e}	---	315.9	1383.7

Emissions using emission factors for all Treaters

$$pollutant\ \frac{lb}{hour} = Ef_i \frac{lb}{MMBtu} * heat\ input\ rate\ \frac{MMBtu}{hr}$$

Emission Unit:
E-5 Production Flare

E-5 Production Flare

Hydrogen Sulfide (H_2S) is present in the emulsion and oil handled in the process. H_2S prefers the gas phase and will naturally evolve from the liquid components at elevated temperatures, low pressure and atmospheric conditions such as those found in the treater vessel. This gas cannot simply be released into the atmosphere, as it is an extremely poisonous gas and is present in quantities that would create an unsafe working environment for Marathon employees at the facility. The flares installed at the E-5 facility operate entirely as a safety device. The facility would not be able to operate safely without the flares making them intrinsic to the proper operation of the facility and its processes.

The E-5 Production flare is a custom-made device manufactured by Marathon and does not have published manufacturer's specification. The destruction rate efficiency for VOC and BTEX is approximated at 95 percent. NO_X and CO components are a direct result of hydrocarbon destruction by the flare and as such are not controlled by the unit. NO_X and CO emissions have been calculated with a flare gas sample and EPA AP-42 emission factors for Flare Operations (Table 13.5-1). Greenhouse gas emissions have been calculated by the methodologies set forth by 40 CFR 98, Subpart W flare emission calculation.

Steamboat Butte E-5 Production Flare Emissions

WR Steamboat E Flared Gas Analysis (11/4/2010)

Component	lb/mole	Btu/scf	Carbon	Flare Feed (mol%)	CO_2 Combustion Volumes (scfh)
N_2	28	0	0	8.795	0.0
CO_2	44	0	1	4.915	265.2
H_2S	34	637	0	2.315	0.0
C_1	16	1010	1	57.127	2928.0
C_2	30	1769	2	8.292	850.0
C_3	44	2515	3	6.713	1032.1
i-C_4	58	3526	4	2.215	454.2
n-C_4	58	3262	4	3.258	668.0
i-C_5	72	4000	5	1.981	507.7
n-C_5	72	4010	5	1.271	325.6
C_6	86	4756	6	1.113	342.3
C_7	100	5503	7	0.855	306.9
C_8	114	6250	8	0.325	133.4
C_9	128	6997	9	0.091	42.0
C_{10}	142	7742	10	0.000	0.0
C_{11}^+	156	8447	11	0.000	0.0
Benzene	78	3745	6	0.023	7.0
Toluene	92	4479	7	0.027	9.7
E-Benzene	106	5227	8	0.010	4.1
Xylenes	106	5213	8	0.126	51.7
n-C_6	86	4756	6	0.548	168.6
Total	28.468			100.000	8096.48

VOC MW (lb/mol)	61.583		
Flare DRE (%)			95.00
Production Gas (scfh)			3950
Additional Treater 1 Fuel (scfh)			723
Additional Treater 2 Fuel (scfh)			723
Pilot Gas (scfh)			0
Total Flared (scfh)			5395
Pilot Rating (MMBTU/hr)			0.25
BTU/scf			1384
NOx Emission Factor		0.068	lb/MMBTU
CO Emission Factor		0.37	lb/MMBTU

Flare emission factors obtained from AP 42 Table 13.5-1 Emission Factors for Flare Operations

Steamboat Butte E-5 Production 2012+ Flare Emissions

Criteria Pollutant Emissions

NO_X	(lb/hr)	0.51
	(tpy)	2.22
CO	(lb/hr)	2.76
	(tpy)	12.10
VOC	(lb/hr)	8.13
	(tpy)	35.63
SO_2	(lb/hr)	20.03
	(tpy)	87.75

HAP Pollutant Emissions

Total HAP	(lb/hr)	0.47
	(tpy)	2.05
Benzene	(lb/hr)	0.01
	(tpy)	0.06
Toluene	(lb/hr)	0.02
	(tpy)	0.08
E-Benzene	(lb/hr)	0.01
	(tpy)	0.03
Xylenes	(lb/hr)	0.10
	(tpy)	0.42
n-Hexane	(lb/hr)	0.34
	(tpy)	1.47

Greenhouse Gas Pollutant Emissions

CO_2 Uncombusted	(lb/hr)	30.79
	(tpy)	134.85
CH_4 Uncombusted	(lb/hr)	6.51
	(tpy)	28.50
CO_2 Combusted	(lb/hr)	909.17
	(tpy)	3982.18
N_2O	(lb/hr)	0.002
	(tpy)	0.007
CO_{2e} Emissions	(lb/hr)	1077.09
	(tpy)	4715.43

Hydrogen Sulfide

H_2S	(lb/hr)	0.56
	(tpy)	2.45

E-5 Production Flare Calculations:

Heat of Combustion

$$\text{Heat of Combustion } \frac{Btu}{scf} = \left(\sum_i \left(\text{C}_\text{i} \frac{mol\,\%}{100}\right)\left(H_i \frac{Btu}{scf}\right)\right) = 1{,}384 \frac{Btu}{scf}$$

NO_X Emission Rate (AP42, Table 13.5-1)

$$\text{NO}_\text{X} \text{ Emission Rate } \frac{lb}{hr} = \frac{\left(0.068 \frac{lb}{MMBtu}\right)\left(1{,}384 \frac{Btu}{scf}\right)\left(5{,}395 \frac{scf}{hr}\right)}{\left(10^6 \frac{Btu}{MMBtu}\right)} = 0.51 \frac{lb}{hr}$$

CO Emission Rate (AP42, Table 13.5-1)

$$\text{CO Emission Rate } \frac{lb}{hr} = \frac{\left(0.37 \frac{lb}{MMBtu}\right)\left(1{,}384 \frac{Btu}{scf}\right)\left(5{,}395 \frac{scf}{hr}\right)}{\left(10^6 \frac{Btu}{MMBtu}\right)} = 3.29 \frac{lb}{hr}$$

VOC Emission Rate

$$\text{VOC Emission Rate } \frac{lb}{hr} = \frac{\left(5{,}395 \frac{scf}{hr}\right)\left(18.557 \frac{moles\ VOC}{100\ moles}\right)\left(61.583 \frac{lb\ VOC}{mole\ VOC}\right)}{\left(379 \frac{scf}{mole}\right)}\left(1 - \frac{95\%}{100}\right) = 8.31 \frac{lb}{hr}$$

SO_2 Emission Rate

$$\text{SO}_2 \text{ Emission Rate } \frac{lb}{hr} = \frac{\left(5{,}395 \frac{scf}{hr}\right)\left(2.315 \frac{moles\ H_2S}{100\ moles}\right)\left(1 \frac{mole\ SO_2}{mole\ H_sS}\right)\left(64 \frac{lb\ SO_2}{mole\ SO_2}\right)\left(\frac{95\%}{100}\right)}{\left(379 \frac{scf}{mole}\right)} = 20.03 \frac{lb}{hr}$$

n-C_6 Emission Rate

$$\text{nC}_6 \text{ Emission Rate } \frac{lb}{hr} = \frac{\left(5{,}395 \frac{scf}{hr}\right)\left(0.548 \frac{moles}{100\ moles}\right)\left(86 \frac{lb}{mole}\right)}{\left(379 \frac{scf}{mole}\right)}\left(1 - \frac{95\%}{100}\right) = 0.34 \frac{lb}{hr}$$

Benzene Emission Rate

$$\text{Benzene Emission Rate } \frac{lb}{hr} = \frac{\left(5{,}395 \frac{scf}{hr}\right)\left(0.023 \frac{moles}{100\ moles}\right)\left(78 \frac{lb}{mole}\right)}{\left(379 \frac{scf}{mole}\right)}\left(1 - \frac{95\%}{100}\right) = 0.01 \frac{lb}{hr}$$

Toluene Emission Rate

$$\text{Toluene Emission Rate } \frac{lb}{hr} = \frac{\left(5{,}395\frac{scf}{hr}\right)\left(0.027\frac{moles}{100\ moles}\right)\left(92\frac{lb}{mole}\right)}{\left(379\frac{scf}{mole}\right)}\left(1-\frac{95\%}{100}\right) = 0.02\frac{lb}{hr}$$

Ethyl Benzene Emission Rate

$$\text{Ethyl Benzene Emission Rate } \frac{lb}{hr} = \frac{\left(5{,}395\frac{scf}{hr}\right)\left(0.010\frac{moles}{100\ moles}\right)\left(106\frac{lb}{mole}\right)}{\left(379\frac{scf}{mole}\right)}\left(1-\frac{95\%}{100}\right) = 0.01\ \frac{lb}{hr}$$

Xylene Emission Rate

$$\text{Xylene Emission Rate } \frac{lb}{hr} = \frac{\left(5{,}395\frac{scf}{hr}\right)\left(0.126\frac{moles}{100\ moles}\right)\left(106\frac{lb}{mole}\right)}{\left(379\frac{scf}{mole}\right)}\left(1-\frac{95\%}{100}\right) = 0.1\ \frac{lb}{hr}$$

Uncombusted CO_2

$$\text{Uncombusted } CO_2 \text{ Emission Rate } \frac{lb}{hr}$$
$$= \left(5{,}395\frac{scf}{hr}\right)\left(4.915\frac{moles}{100\ moles}\right)\left(\frac{1\ lb\ mole}{379\ scf}\right)\left(44\frac{lbs}{lb\ Mole}\right) = 30.784\ \frac{lb}{hr}$$

Uncombusted CH_4

$$\text{Uncombusted } CH_4 \text{ Emission Rate } \frac{lb}{hr}$$
$$= \left(5{,}395\frac{scf}{hr}\right)\left(57.127\frac{moles}{100\ moles}\right)\left(\frac{1\ lb\ mole}{379\ scf}\right)\left(16\frac{lbs}{lb\ Mole}\right)\left(1-\frac{95\%}{100}\right) = 6.51\ \frac{lb}{hr}$$

Combusted CO_2

$$\text{Combusted } CO_2 \text{ Emission Rate } \frac{lb}{hr}$$
$$= \left[\sum_i (CarbonCount_i)\left(C_i\frac{mole}{100\ moles}\right)\right]\left(5{,}395\frac{scf}{hr}\right)\left(\frac{1\ lb\ mole}{379\ scf}\right)\left(\frac{95\%}{100}\right)\left(44\frac{lb}{lb\ mole}\right) = 909.17\ \frac{lb}{hr}$$

CO_{2e}

$$CO_{2e}\ Emission\ Rate = \left(30.784\frac{lb}{hr} + 909.17\frac{lb}{hr}\right) + \left(6.51\frac{lb}{hr}\right)(21\ GWP) + \left(0.002\frac{lb}{hr}\right)(310\ GWP)$$
$$= 1077.09\frac{lb}{hr}$$

Hydrogen Sulfide Emission Rate

$$\text{H}_2\text{S Emission Rate } \frac{lb}{hr} = \frac{\left(5{,}395\frac{scf}{hr}\right)\left(2.315\frac{moles}{100\ moles}\right)\left(34\frac{lb}{mole}\right)}{\left(379\frac{scf}{mole}\right)}\left(1-\frac{95\%}{100}\right) = 0.56\frac{lb}{hr}$$

E-5 Oil Storage Tank Flare

Hydrogen Sulfide (H_2S) is present in the emulsion and oil handled in the process. H_2S prefers the gas phase and will naturally evolve from the liquid components at elevated temperatures, low pressure and atmospheric conditions such as those found in the treater vessel. This gas cannot simply be released into the atmosphere, as it is an extremely poisonous gas and is present in quantities that would create an unsafe working environment for Marathon employees at the facility. The flares installed at the E-5 facility operate entirely as a safety device. The facility would not be able to operate safely without the flare making it intrinsic to the proper operation of the facility and its processes.

The E-5 Oil Storage Tank flare is a custom-made device manufactured by Marathon and does not have published manufacturer's specification. The destruction rate efficiency for VOC and BTEX is approximated at 95 percent. NO_X and CO components are a direct result of hydrocarbon destruction by the flare and as such are not controlled by the unit. NO_X and CO emissions have been calculated with a flare gas sample and EPA AP-42 emission factors for Flare Operations (Table 13.5 -1). Greenhouse gas emissions have been calculated by the methodologies set forth by 40 CFR 98, Subpart W flare emission calculation.

Steamboat Butte E-5 Oil Storage Tank Flare Emissions

E Battery Tank Flare Analysis (11/4/2010)

Component	lb/mole	Btu/scf	Carbon	Flare Feed (mol%)	CO_2 Combustion Volumes (scfh)
N_2	28	0	0	9.380	0.0
CO_2	44	0	1	5.058	41.1
H_2S	34	637	0	3.719	0.0
C_1	16	1010	1	35.098	270.9
C_2	30	1769	2	11.546	178.3
C_3	44	2515	3	13.685	316.9
i-C_4	58	3526	4	4.935	152.4
n-C_4	58	3262	4	7.516	232.1
i-C_5	72	4000	5	4.048	156.3
n-C_5	72	4010	5	2.320	89.6
C_6	86	4756	6	1.185	54.9
C_7	100	5503	7	0.561	30.3
C_8	114	6250	8	0.201	12.4
C_9	128	6997	9	0.049	3.4
C_{10}	142	7742	10	0.000	0.0
C_{11}^+	156	8447	11	0.000	0.0
Benzene	78	3745	6	0.017	0.8
Toluene	92	4479	7	0.035	1.9
E-Benzene	106	5227	8	0.005	0.3
Xylenes	106	5213	8	0.058	3.6
n-C_6	86	4756	6	0.584	27.0
Total	35.513			100.000	1572.04

VOC MW (lb/mol)	57.713		
Flare DRE (%)			95.00
Tank Gas (scfh)			812.55
Pilot Gas (scfh)			0
Total Flare Gas (scfh)			812.55
Pilot Rating (MMBTU/hr)			0.25
BTU/scf			1737
NOx Emission Factor		0.068	lb/MMBTU
CO Emission Factor		0.37	lb/MMBTU

Flare emission factors obtained from AP 42 Table 13.5-1 Emission Factors for Flare Operations

Steamboat Butte E-5 Oil Storage Tank 2012+ Flare Emissions

Criteria Pollutant Emissions

NO_X	(lb/hr)	0.10
	(tpy)	0.42
CO	(lb/hr)	0.52
	(tpy)	2.29
VOC	(lb/hr)	2.18
	(tpy)	9.54
SO_2	(lb/hr)	4.85
	(tpy)	21.23

HAP Pollutant Emissions

Total HAP	(lb/hr)	0.07
	(tpy)	0.29
Benzene	(lb/hr)	0.001
	(tpy)	0.006
Toluene	(lb/hr)	0.003
	(tpy)	0.015
E-Benzene	(lb/hr)	0.001
	(tpy)	0.002
Xylenes	(lb/hr)	0.007
	(tpy)	0.03
n-Hexane	(lb/hr)	0.05
	(tpy)	0.24

Greenhouse Gas Pollutant Emissions

CO_2 Uncombusted	(lb/hr)	4.77
	(tpy)	20.90
CH_4 Uncombusted	(lb/hr)	0.60
	(tpy)	2.64
CO_2 Combusted	(lb/hr)	177.74
	(tpy)	778.48
N_2O	(lb/hr)	0.000
	(tpy)	0.001
CO_{2e} Emissions	(lb/hr)	195.24
	(tpy)	855.17

Hydrogen Sulfide

H_2S	(lb/hr)	0.14
	(tpy)	0.60

E-5 Tank Flare Calculations:

Heat of Combustion

$$\text{Heat of Combustion } \frac{Btu}{scf} = \left(\sum_i \left(C_i \frac{mol\,\%}{100}\right)\left(H_i \frac{Btu}{scf}\right)\right) = 1{,}737 \frac{Btu}{scf}$$

NO_X Emission Rate (AP42, Table 13.5-1)

$$\text{NO}_\text{X}\text{ Emission Rate } \frac{lb}{hr} = \frac{\left(0.068\frac{lb}{MMBtu}\right)\left(1{,}737\frac{Btu}{scf}\right)\left(812.55\frac{scf}{hr}\right)}{\left(10^6\frac{Btu}{MMBtu}\right)} = 0.10\frac{lb}{hr}$$

CO Emission Rate (AP42, Table 13.5-1)

$$\text{CO Emission Rate } \frac{lb}{hr} = \frac{\left(0.37\frac{lb}{MMBtu}\right)\left(1{,}737\frac{Btu}{scf}\right)\left(812.55\frac{scf}{hr}\right)}{\left(10^6\frac{Btu}{MMBtu}\right)} = 0.52\frac{lb}{hr}$$

VOC Emission Rate

$$\text{VOC Emission Rate } \frac{lb}{hr} = \frac{\left(812.55\frac{scf}{hr}\right)\left(35.2\frac{moles\ VOC}{100\ moles}\right)\left(57.713\frac{lb\ VOC}{mole\ VOC}\right)}{\left(379\frac{scf}{mole}\right)}\left(1-\frac{95\%}{100}\right) = 2.18\frac{lb}{hr}$$

SO_2 Emission Rate

$$\text{SO}_2\text{ Emission Rate } \frac{lb}{hr} = \frac{\left(812.55\frac{scf}{hr}\right)\left(3.719\frac{moles\ H_2S}{100\ moles}\right)\left(1\frac{mole\ SO_2}{mole\ H_sS}\right)\left(64\frac{lb\ SO_2}{mole\ SO_2}\right)\left(\frac{95\%}{100}\right)}{\left(379\frac{scf}{mole}\right)} = 4.85\frac{lb}{hr}$$

n-C_6 Emission Rate

$$\text{nC}_6\text{ Emission Rate } \frac{lb}{hr} = \frac{\left(812.55\frac{scf}{hr}\right)\left(1.185\frac{moles}{100\ moles}\right)\left(86\frac{lb}{mole}\right)}{\left(379\frac{scf}{mole}\right)}\left(1-\frac{95\%}{100}\right) = 0.05\frac{lb}{hr}$$

Benzene Emission Rate

$$\text{Benzene Emission Rate } \frac{lb}{hr} = \frac{\left(812.55\frac{scf}{hr}\right)\left(0.017\frac{moles}{100\ moles}\right)\left(78\frac{lb}{mole}\right)}{\left(379\frac{scf}{mole}\right)}\left(1-\frac{95\%}{100}\right) = 0.001\frac{lb}{hr}$$

Toluene Emission Rate

$$\text{Toluene Emission Rate } \frac{lb}{hr} = \frac{\left(812.55\frac{scf}{hr}\right)\left(0.035\frac{moles}{100\ moles}\right)\left(92\frac{lb}{mole}\right)}{\left(379\frac{scf}{mole}\right)}\left(1-\frac{95\%}{100}\right) = 0.003\frac{lb}{hr}$$

Ethyl Benzene Emission Rate

$$\text{Ethyl Benzene Emission Rate } \frac{lb}{hr} = \frac{\left(812.55\frac{scf}{hr}\right)\left(0.005\frac{moles}{100\ moles}\right)\left(106\frac{lb}{mole}\right)}{\left(379\frac{scf}{mole}\right)}\left(1-\frac{95\%}{100}\right) = 0.0006\ \frac{lb}{hr}$$

Xylene Emission Rate

$$\text{Xylene Emission Rate } \frac{lb}{hr} = \frac{\left(812.55\frac{scf}{hr}\right)\left(0.058\frac{moles}{100\ moles}\right)\left(106\frac{lb}{mole}\right)}{\left(379\frac{scf}{mole}\right)}\left(1-\frac{95\%}{100}\right) = 0.007\ \frac{lb}{hr}$$

Uncombusted CO_2

$$\text{Uncombusted } CO_2 \text{ Emission Rate } \frac{lb}{hr}$$
$$= \left(812.55\frac{scf}{hr}\right)\left(5.058\frac{moles}{100\ moles}\right)\left(\frac{lb\ mole}{379\ scf}\right)\left(44\frac{lb}{lb\ mole}\right) = 4.77\ \frac{lb}{hr}$$

Uncombusted CH_4

$$\text{Uncombusted } CH_4 \text{ Emission Rate } \frac{lb}{hr}$$
$$= \left(812.55\frac{scf}{hr}\right)\left(35.098\frac{moles}{100\ moles}\right)\left(16\frac{lb}{lb\ mole}\right)\left(\frac{lb\ mole}{379\ scf}\right)\left(1-\frac{95\%}{100}\right) = 0.6\ \frac{lb}{hr}$$

Combusted CO_2

$$\text{Combusted } CO_2 \text{ Emission Rate } \frac{lb}{hr}$$
$$= \left[\sum_i (CarbonCount_i)\left(C_i\frac{mole}{100\ moles}\right)\right]\left(812.55\frac{scf}{hr}\right)\left(\frac{1\ lb\ mole}{379\ scf}\right)\left(\frac{95\%}{100}\right)\left(44\frac{lb}{lb\ mole}\right) = 177.74\ \frac{lb}{hr}$$

CO_{2e}

$$CO_{2e}\ Emission\ Rate = \left(4.77\frac{lb}{hr} + 177.74\frac{lb}{hr}\right) + \left(0.6\frac{lb}{hr}\right)(21\ GWP) + \left(0.0003\frac{lb}{hr}\right)(310\ GWP) = 195.24\frac{lb}{hr}$$

Hydrogen Sulfide Emission Rate

$$\text{H}_2\text{S Emission Rate } \frac{lb}{hr} = \frac{\left(812.55\frac{scf}{hr}\right)\left(3.719\frac{moles}{100\ moles}\right)\left(34\frac{lb}{mole}\right)}{\left(379\frac{scf}{mole}\right)}\left(1-\frac{98\%}{100}\right) = 0.14\frac{lb}{hr}$$

PRECISION ANALYSIS

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Run File	C:\Galaxie Workstation\data\10_11_04\E BATTERY TANK FLARE5_3.DATA		
Method	S2_BTEX,H2S(high)		
Operator	User1	**Analysis Date**	11/4/2010
Client:	MARATHON	**Date Sampled:**	11/4/2010
Sample Identification:	E BATTERY TANK FLARE	**Purpose:**	
Unique #:		**Pressure:**	1 PSI
Sample Temperature:	60 DEG F	**Type Sample:**	ON-SITE
Sampled by:	ANDY FONTAINE	**County:**	FREMONT

Component	Mole %	BTU	GPM
Hydrogen Sulfide	3.7190	23.7489	0.0000
Nitrogen (N2)	9.3799	0.0000	0.0000
Carbon Dioxide	5.0580	0.0000	0.0000
Methane (CH4)	35.0980	355.3102	0.0000
Ethane (C2)	11.5459	204.7997	3.0870
Propane (C3)	13.6851	345.1277	3.7693
iso-Butane (i-C4)	4.9352	160.8577	1.6146
Butane (C4)	7.5156	245.7499	2.3688
iso-Pentane (i-C5)	4.0484	162.3471	1.4802
Pentane (C5)	2.3204	93.2348	0.8409
Hexanes (C6)	1.7690	84.3257	0.7273
Heptanes (C7)	0.5610	30.9429	0.2588
Octanes (C8)	0.2005	12.5583	0.1027
Nonanes (C9)	0.0492	3.4520	0.0277
Decanes+	0.0000	0.0000	0.0000
Benzene	0.0168	0.6285	0.0047
Toluene	0.0348	1.5621	0.0117
Ethylbenzene	0.0048	0.2529	0.0019
Xylenes	0.0583	3.0436	0.0222
Totals	100.0000	1727.9421	14.3176

Specific Gravity from Composition	1.2399				
BTUs @ 14.730 Saturated	1697.8691	**BTUs @**	**14.730**	**Saturated (Real)**	1714.3051
BTUs @ 14.730 Dry	1727.9421	**BTUs @**	**14.730**	**Dry (Real)**	1744.6693
Compressibility	0.99041				

Emission Unit:
E-5 Concrete Tank

E-5 Concrete Tank Emissions

Emission unit SBE5B-320 is a concrete tank open to the atmosphere that stores fluid brought to the surface during well workover and completion activities. The use of the tank is highly variable but is estimated at a weekly throughput of 400 barrels. The liquids stored in the tank are mostly water with an estimated composition of one mole percent oil. Oil that comes to the surface of the tank is skimmed and added to the battery. Emissions from the tank were estimated using Water9 V3. The Water9 emission model does not account for recovery from skimming the tank, so the estimates are highly conservative. The concrete tank composition was estimated using the method outlined below.

Oil Composition- The oil analysis for E-5 only reports constituents through C10+. The C10+ fraction represents 75.81 mole% and 88.51 weight % of the oil sample. A Gaussian distribution was used to speciate the C10+ constituents in an effort to more accurately represent the C10+ fraction volatility of the oil.

The average molecular weight of the E-5-Battery oil sample is 224.56, while the average molecular weight of the C10+ fraction is 262.17. The average molecular weight for C10+ falls between that of C18 and C19, and as such, the mean value for the Gaussian distribution based on carbon number was chosen to be between C18 and C19 constituents.

$$Mole\ \% = \frac{1}{V * \sqrt{2 * pi}} * e^{\left(-\left(\frac{1}{2}\right)*\left(\frac{x-u}{V}\right)^2\right)} * Factor + Y\ shift$$

Where V is the Standard Deviation, u is the mean, x is the number of carbons in the hydrocarbon, Factor is used to increase the area under the curve from one to the C10+ Mole percent and Y shift is used to elevate the range from a base value of zero.

Table 1 Distribution Equation Values

Equation Parameters	
Standard Deviation (V)	2.2
Mean(u)	18.65
Factor	36.2
Y shift	2.2

The Factor, Standard Deviation and Y shift values were manipulated incrementally so that the representative composition matched the average molecular weight, Mole % of C10+ species and average molecular weight of C10+ constituents of those reported by the oil sample analysis.

Table 2 Oil Composition

Oil Composition	
Marathon -E-5 Battery Bulk Treater Pressurized Crude Oil 11/4/2011 By AMERICAN MOBILE RESEARCH, Inc.	
Sample MW	**224.56**
Estimated MW	224.71
Sample C10+	**75.81**
Estimated C10+	75.80
Sample MW C10+	**262.17**
Estimated Average MW C10+	262.23

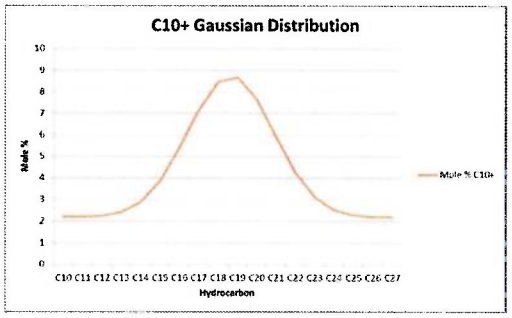


Figure 1 C10+ estimated distribution

The resulting distribution of the C10+ fraction is provided below in the oil composition columns. The final concrete tanks composition columns show the values that were entered into the Water9 simulation.

Table 3 Water9 input/output

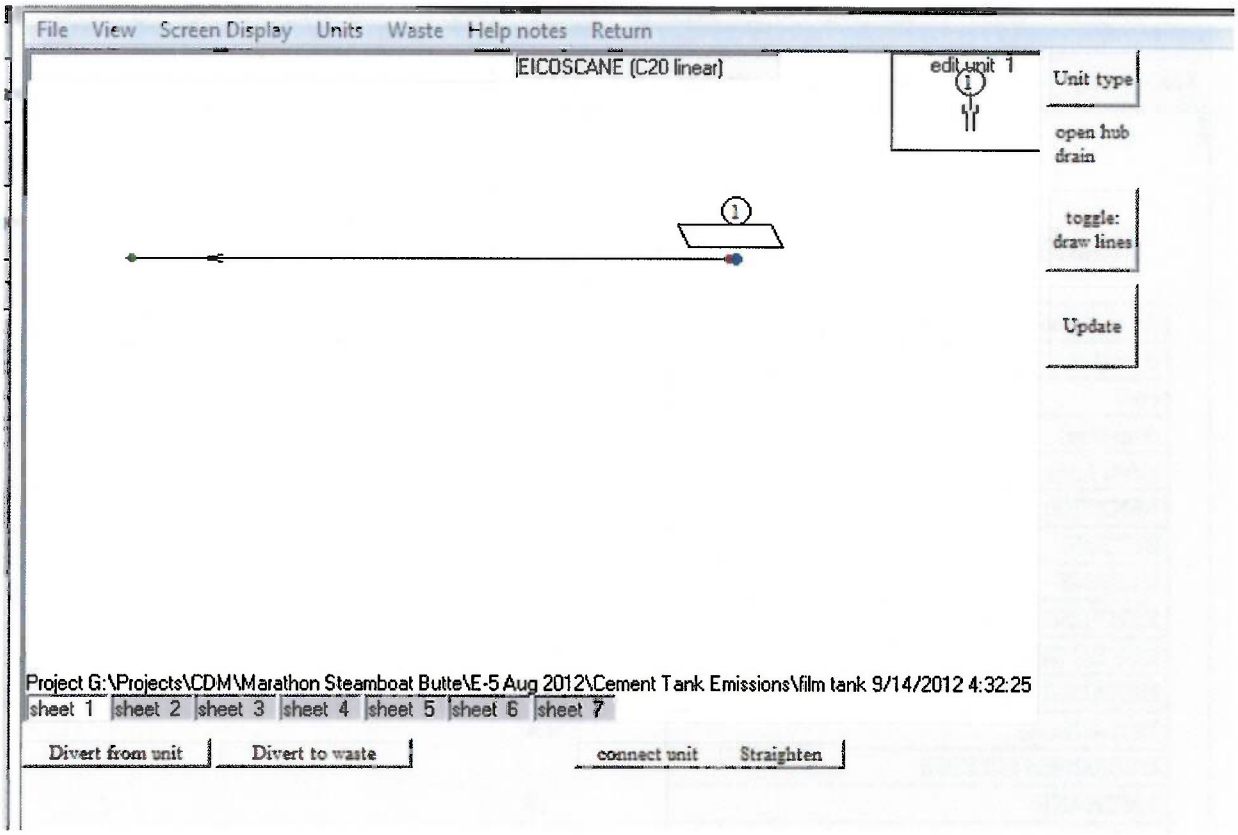
Species	Produced Water Composition		Oil composition		Final Concrete Tanks Composition*		Water9 estimated emissions	
	mole %	PPM	mole %	PPM	mole %	PPM	Mg/yr	tpy
Water	99.000	990000.000	0.000	0.00	99.000	990000.000		0.000
Hydrogen Sulfide	0.000	0.000	0.000	0.00	0.000	0.000	0.000	0.000
Carbon Dioxide	0.000	0.000	0.047	470.00	0.000	4.700	**0.017**	0.018
Nitrogen	0.000	0.000	0.003	30.00	0.000	0.300	--	--
Methane	0.000	0.000	0.190	1900.00	0.002	19.000	0.063	0.069
Ethane	0.000	0.000	0.132	1320.00	0.001	13.200	0.044	0.048
Propane	0.000	0.000	0.347	3470.00	0.003	34.700	0.115	0.127
Isobutane	0.000	0.000	0.211	2110.00	0.002	21.100	0.070	0.077
Butane	0.000	0.000	0.514	5140.00	0.005	51.400	0.170	0.187
Isopentane	0.000	0.000	0.590	5900.00	0.006	59.000	0.195	0.215
Pentane	0.000	0.000	0.618	6180.00	0.006	61.800	0.204	0.224
Hexane	0.000	0.000	0.872	8720.00	0.009	87.200	**0.577**	0.635
Heptane	0.000	0.000	3.794	37940.00	0.038	379.400	1.250	1.375
Octane	0.000	0.000	8.831	88310.00	0.088	883.100	2.920	3.212
Nonane	0.000	0.000	6.106	61060.00	0.061	610.600	1.060	1.166
Decane	0.000	0.000	2.203	22028.86	0.022	220.289	0.166	0.183
Benzene	0.000	0.000	0.218	2180.00	0.002	21.800	0.072	0.079
Toluene	0.000	0.000	0.439	4390.00	0.004	43.900	0.145	0.160
Ethylbenzene	0.000	0.000	0.147	1470.00	0.001	14.700	0.049	0.053
p-Xylene	0.000	0.000	0.255	2550.00	0.003	25.500	**0.090**	0.098
o-Xylene	0.000	0.000	0.061	610.00	0.001	6.100	--	--
m-Xylene	0.000	0.000	0.041	410.00	0.000	4.100	--	--
2,2,4-Trimethylpentane	0.000	0.000	0.075	750.00	0.001	7.500	0.025	0.027
2-Methylpentane	0.000	0.000	0.623	6230.00	0.006	62.300	--	--
3-Methylpentane	0.000	0.000	0.249	2490.00	0.002	24.900	--	--
Undecane	0.000	0.000	2.216	22155.44	0.022	221.554	0.061	0.067
dodecane	0.000	0.000	2.268	22681.00	0.023	226.810	0.019	0.020
Tridecane	0.000	0.000	2.443	24426.55	0.024	244.265	0.008	0.008
Tetradecane	0.000	0.000	2.903	29032.34	0.029	290.323	0.002	0.002
Pentadecane	0.000	0.000	3.858	38576.02	0.039	385.760	0.001	0.001
Hexadecane	0.000	0.000	5.378	53778.29	0.054	537.783	0.000	0.000
Heptadecane	0.000	0.000	7.155	71550.80	0.072	715.508	0.000	0.000
Octadecane	0.000	0.000	8.484	84840.62	0.085	848.406	0.000	0.000
Nonadecane	0.000	0.000	8.682	86818.65	0.087	868.186	0.000	0.000
Eicoscanes+	0.000	0.000	30.210	302100.000	0.302	3021.000	0.000	0.000

*Tank contents estimated to be 98.9% water and 1.1% oil by volume

Air emissions are based on a throughput of .10486 liter per second flow rate through an oil film unit

-- indicates species were not available for Water9 inputs so amounts were added to counterparts in same colored blocks bolded species received mole% of missing species

Emissions- The summary of emissions from the Water9 simulation is in table 3 under the water9 estimated emissions column and in table 4 below.


File View Screen Display Units Waste Help notes Return
EICOSCANE (C20 linear)
edit unit 1
1
Unit type
open hub drain
toggle: draw lines
Update
1
Project G:\Projects\CDM\Marathon Steamboat Butte\E-5 Aug 2012\Cement Tank Emissions\film tank 9/14/2012 4:32:25
sheet 1 sheet 2 sheet 3 sheet 4 sheet 5 sheet 6 sheet 7
Divert from unit
Divert to waste
connect unit
Straighten

Wastewater Collection and Treatment Units

File View Screen Display Units Waste Help notes Return

EICOSCANE (C20 linear) | 1 | 1

Shift waste | Insert row

Delete the compound

Return from waste edit

HELP

.1048622

All compound concentrations in ppm	waste 1	waste 2	waste 3	waste 4	wa
flow (l/s)	.1048622				
code					
drop (cm)					
radius (cm)					
BENZENE	21.8				
BUTANE	51.4				
ETHANE	13.2				
ETHYLBENZENE	14.7				
HEPTANE(-n)	379.4				
HEXADECANE N	715.5				
HEXANE(-n)	174.4				
HYDROGEN SULFIDE					
METHANE	19				
OCTANE	883.1				
PENTANE	61.8				
PROPANE	34.7				
TOLUENE	43.9				
TRIMETHYLPENTANE 2,2,4	7.5				
WATER	990000				
XYLENE	35.7				
TETRADECANE	290.3				
DODECANE (C12 linear)	226.8				
UNDECANE (C11 linear)	221.55				
DECANE (C10 linear)	220.288				
ISOPENTANE	59				
ISOBUTANE	21.1				
NONANE C9H20	610.6				
CARBON DIOXIDE	5				
TRIDECANE (C13 linear)	244.265				
PENTADECANE (C15 linear)	385.76				
HEPTADECANE (C17 linear)	715.5				
OCTADECANE (C18 linear)	848.186				
NONADECANE (C19 linear)	868.1865				
EICOSCANE (C20 linear)	3021				

Project G:\Projects\CDM\Marathon Steamboat Butte\E-5 Aug 2012\Cement Tank Emissions\film tank 9/14/201

sheet 1 | sheet 2 | sheet 3 | sheet 4 | sheet 5 | sheet 6 | sheet 7

Divert from unit | Divert to waste

Display

WASTEWATER TREATMENT SUMMARY I 09-14-2012 16:58:23

Project G:\Projects\CDM\Marathon Steamboat Butte\E-5 Aug 2012\Cement Tank Emissions\film tank 9/14/2012 4:32:

COMPOUND	RATE (g/s)	Fraction Air	Removal	Exit	Adsorb	error	emissions
BENZENE	2.29E-03	1.	.	.	0.0000	0.0000	(7.21E-02 Mg/yr)
BUTANE	5.39E-03	1.	.	.	0.0000	0.0000	(1.70E-01 Mg/yr)
ETHANE	1.38E-03	1.	.	.	0.0000	0.0000	(4.37E-02 Mg/yr)
ETHYLBENZENE	1.54E-03	1.	.	.	0.0000	0.0000	(4.86E-02 Mg/yr)
HEPTANE(-n)	3.98E-02	1.	.	.	0.0000	0.0000	(1.25E+00 Mg/yr)
HEXADECANE N	0.00E+00	.	.	1.	0.0000	0.0000	(0.00E+00 Mg/yr)
HEXANE(-n)	1.83E-02	1.	.	.	0.0000	0.0000	(5.77E-01 Mg/yr)
HYDROGEN SULFIDE	1.05E-24	1.	.	.	0.0000	0.0000	(3.31E-23 Mg/yr)
METHANE	1.99E-03	1.	.	.	0.0000	0.0000	(6.28E-02 Mg/yr)
OCTANE	9.26E-02	1.	.	.	0.0000	0.0000	(2.92E+00 Mg/yr)
PENTANE	6.48E-03	1.	.	.	0.0000	0.0000	(2.04E-01 Mg/yr)
PROPANE	3.64E-03	1.	.	.	0.0000	0.0000	(1.15E-01 Mg/yr)
TOLUENE	4.60E-03	1.	.	.	0.0000	0.0000	(1.45E-01 Mg/yr)
TRIMETHYLPENTANE 2,2,4	7.86E-04	1.	.	.	0.0000	0.0000	(2.48E-02 Mg/yr)
WATER	1.04E+02	1.	.	.	0.0000	0.0000	(3.27E+03 Mg/yr)
XYLENE	2.84E-03	.75839	.	.2416	0.0000	0.0000	(8.95E-02 Mg/yr)
TETRADECANE	6.56E-05	.00215	.	.9978	0.0000	0.0000	(2.07E-03 Mg/yr)
DODECANE (C12 linear)	5.89E-04	.02475	.	.9752	0.0000	0.0000	(1.86E-02 Mg/yr)
UNDECANE (C11 linear)	1.93E-03	.08323	.	.9168	0.0000	0.0000	(6.10E-02 Mg/yr)
DECANE (C10 linear)	5.27E-03	.22819	.	.7718	0.0000	0.0000	(1.66E-01 Mg/yr)
ISOPENTANE	6.19E-03	1.	.	.	0.0000	0.0000	(1.95E-01 Mg/yr)
ISOBUTANE	2.21E-03	1.	.	.	0.0000	0.0000	(6.98E-02 Mg/yr)
NONANE C9H20	3.36E-02	.52462	.	.4754	0.0000	0.0000	(1.06E+00 Mg/yr)
CARBON DIOXIDE	5.24E-04	1.	.	.	0.0000	0.0000	(1.65E-02 Mg/yr)

Exit | Page UP | Page DOWN | page 1 of 2 pages. | Print | File | ss TSV | Help

Ariel | 8 | Title

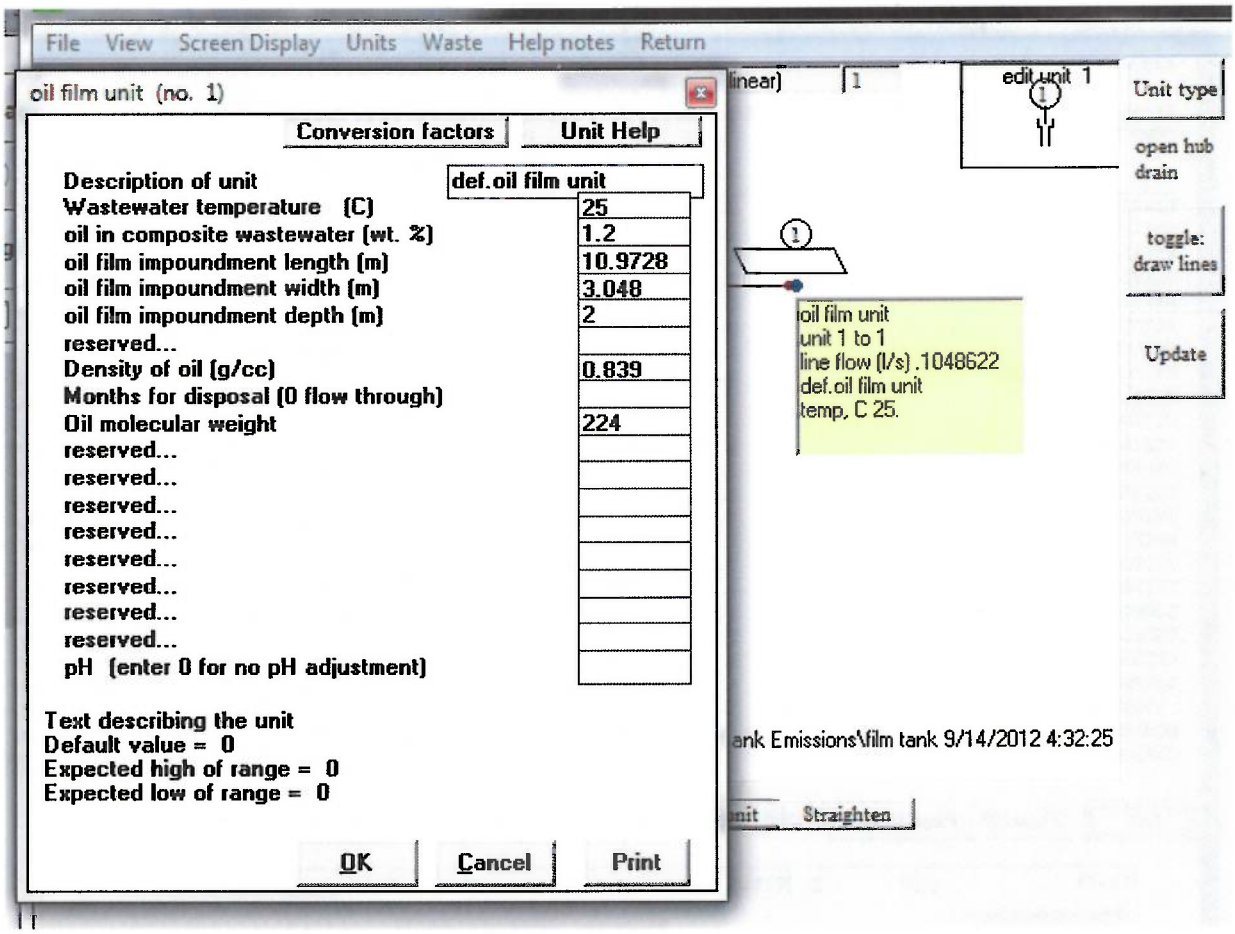
Printer orientation
(•) Portrait
( ) Landscape

Search text | Text here | < | >

Display

TRIDECANE (C13 linear)	2.38E-04	.00928	.	.9907	0.0000	0.0000	(7.50E-03 Mg/yr)
PENTADECANE (C15 linear)	2.32E-05	.00057	.	.9994	0.0000	0.0000	(7.31E-04 Mg/yr)
HEPTADECANE (C17 linear)	0.00E+00	.	.	1.	0.0000	0.0000	(0.00E+00 Mg/yr)
OCTADECANE (C18 linear)	0.00E+00	.	.	1.	0.0000	0.0000	(0.00E+00 Mg/yr)
NONADECANE (C19 linear)	0.00E+00	.	.	1.	0.0000	0.0000	(0.00E+00 Mg/yr)
EICOSCANE (C20 linear)	0.00E+00	.	.	1.	0.0000	0.0000	(0.00E+00 Mg/yr)

TOTAL ALL COMPOUNDS 1.04E+02 g/s air emissions
TOTAL ALL COMPOUNDS 3.28E+03 Mg/yr air emissions


File View Screen Display Units Waste Help notes Return
oil film unit (no. 1)
Conversion factors
Unit Help
Description of unit
def.oil film unit
Wastewater temperature (C)
25
oil in composite wastewater (wt. %)
1.2
oil film impoundment length (m)
10.9728
oil film impoundment width (m)
3.048
oil film impoundment depth (m)
2
reserved...
Density of oil (g/cc)
0.839
Months for disposal (0 flow through)
Oil molecular weight
224
reserved...
reserved...
reserved...
reserved...
reserved...
reserved...
reserved...
reserved...
pH (enter 0 for no pH adjustment)
Text describing the unit
Default value = 0
Expected high of range = 0
Expected low of range = 0
OK
Cancel
Print
linear]
1
edit unit 1
Unit type
open hub drain
toggle: draw lines
Update
oil film unit
unit 1 to 1
line flow (l/s) .1048622
def.oil film unit
temp, C 25.
ank Emissions\film tank 9/14/2012 4:32:25
Straighten

POTENTIAL-TO-EMIT SUMMARY

Steamboat Butte E-5 Tank Battery
Potential to Emit Summary
(tpy)

Facility	ID	Unit	Throughput / Rating		NO_X	CO	VOC	n-C_6	Benzene	Toluene	Ethyl Benzene	Xylenes	SO_2	CO_2	CH_4	N_2O	CO_{2e}	H_2S	HAPs
	SBE5B-305	Gas Fired Treater	8760	hr/yr	0.43	0.36	0.02	0.00	0.00	0.00	0.00	0.00	0.00	511.97	0.01	0.00	512.47	--	0.00
	SBE5B-307	Gas Fired Treater	8760	hr/yr	1.16	0.97	0.06	0.00	0.00	0.00	0.00	0.00	0.01	1382.32	0.03	0.00	1383.67	--	0.00
	SBE5B-320	Concrete Tank	400	bbl/wk	--	--	7.92	0.63	0.08	0.16	0.05	0.10	--	0.02	0.07	--	1.47	0	1.03
E-5	SBE5B-510	Production Flare	129485	scfd	2.22	12.10	35.63	1.47	0.06	0.08	0.03	0.42	87.75	4117.03	28.50	0.01	4715.43	2.45	2.05
	SBE5B-511	Oil Tank Flare	19501	scfd	0.42	2.29	9.54	0.24	0.01	0.02	0.00	0.03	21.23	799.38	2.64	0.00	854.75	0.60	0.29
	SBE5B-503/504	Water Tank Vents	25167.6	bpd	---	---	7.05	0.37	0.04	0.03	0.00	0.00	---	16.39	3.74	---	94.85	3.18	0.44
	SBE5B-FUG	Fugitives	8760	hr/yr	---	---	0.20	0.01	0.00	0.00	0.00	0.01	---	0.18	0.25	---	5.46	--	0.02
Operations Total					**4.23**	**15.72**	**60.42**	**2.72**	**0.18**	**0.28**	**0.09**	**0.55**	**109.00**	**6827.28**	**35.22**	**0.01**	**7568.09**	**6.23**	**3.83**

ACTUAL EMISSIONS SUMMARY

Steamboat Butte E-5 Tank Battery
2011 Actual Emissions
(tpy)

Facility	ID	Unit	2011 Actual Throughput		NO_X	CO	VOC	n-C_6	Benzene	Toluene	Ethyl Benzene	Xylenes	SO_2	CO_2	CH_4	N_2O	CO_{2e}	H_2S	HAPs
	SBE5B-305	Gas Fired Treater	8760	hr/yr	0.43	0.36	1.91	0.00	0.00	0.00	0.00	0.00	12.37	511.97	0.01	0.00	512.47	--	0.00
	SBE5B-306	Gas Fired Treater	8760	hr/yr	0.43	0.36	1.91	0.00	0.00	0.00	0.00	0.00	12.37	511.97	0.01	0.00	512.47	--	0.00
	SBE5B-320	Cement Tank	400	bbl/wk	--	--	7.92	0.63	0.08	0.16	0.05	0.10	--	0.02	0.07	--	1.47	--	1.03
E-5	SBE5B-510	Production Flare	65827	scfd	1.13	6.15	18.11	0.75	0.03	0.04	0.02	0.21	46.96	2859.05	14.49	0.00	3163.26	1.25	1.04
	SBE5B-511	Oil Tank Flare	13542	scfd	0.29	1.59	6.62	0.16	0.00	0.02	0.00	0.02	15.56	555.12	1.83	0.00	593.87	0.41	0.20
	SBE5B-503/504	Water Tank Vents	18009	bpd	---	---	5.04	0.27	0.03	0.02	0.00	0.00	---	11.73	2.67	---	67.87	2.28	0.32
	SBE5B-FUG	Fugitives	8760	hr/yr	---	---	0.20	0.01	0.00	0.00	0.00	0.01	---	0.18	0.25	---	5.46	--	0.02
Operations Total					**2.28**	**8.46**	**41.72**	**1.83**	**0.14**	**0.23**	**0.07**	**0.34**	**87.27**	**4450.04**	**19.33**	**0.01**	**4856.87**	**3.94**	**2.61**